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Attorney's Docket No. 460-010760-US(PAR) PATENT

Routing Papers

jc872 U.S. PTO 10/023559 12/18/01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Express Mail No.: EL627511313US
Applicant(s): ASIKAINEN et al. **Group No.:**
Serial No.: 0 /
Filed: Herewith **Examiner:**
For: DIRECT-CONVERSION RECEIVER SYSTEM AND METHOD, ESPECIALLY A GPS RECEIVER SYSTEM WITH HIGH PASS FILTERING

Commissioner of Patents
Washington, D.C. 20231

TRANSMITTAL OF CERTIFIED COPY

Attached please find the certified copy of the foreign application from which priority is claimed for this case:

Country	**: Finland**
Application Number	**: 20002832**
Filing Date	**: December 22, 2000**

WARNING: "When a document that is required by statute to be certified must be filed, a copy, including a photocopy or facsimile transmission of the certification is not acceptable." 37 CFR 1.4(f) (emphasis added.)

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NOTE: The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63.

(Transmittal of Certified Copy [5-4])

PATENTTI- JA REKISTERIHALLITUS
NATIONAL BOARD OF PATENTS AND REGISTRATION

Helsinki 30.10.2001

E T U O I K E U S T O D I S T U S
P R I O R I T Y D O C U M E N T

Hakija Applicant	**Nokia Mobile Phones Ltd** **Espoo**
Patenttihakemus nro Patent application no	**20002832**
Tekemispäivä Filing date	**22.12.2000**
Kansainvälinen luokka International class	**H04B**

Keksinnön nimitys
Title of invention

"Direct-conversion receiver system and method, especially a GPS receiver system with high pass filtering"
(Järjestelmä ja menetelmä suoramuunnosvastaanotinta varten, erityisesti GPS-vastaanotinjärjestelmä, jossa on ylipäästösuodatus)

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

Pirjo Kaila
Tutkimussihteeri

Maksu 300,- mk
Fee 300,- FIM

Maksu perustuu kauppa- ja teollisuusministeriön antamaan asetukseen 1782/1995 Patentti- ja rekisterihallituksen maksullisista suoritteista muutoksineen.

The fee is based on the Decree with amendments of the Ministry of Trade and Industry No. 1782/1995 concerning the chargeable services of the National Board of Patents and Registration of Finland.

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Direct-conversion receiver system and method, especially a GPS receiver system with high pass filtering

Background of the invention

The invention relates generally to direct-conversion radio receivers and to methods in direct conversion, especially for phase modulated carrier signals transmitting digital information. The invention also relates to suppression of direct current (DC) offsets generated in receivers.

In digital modulation, the modulating signal is digital, containing a bit stream of "1s" and "0s", and mixed in a modulator with a carrier signal for transmission. The basic modulation schemes are amplitude-shift keying (ASK), frequency-shift keying (FSK) and phase-shift keying (PSK). In PSK, the signals representing the states "1" and "0" have a difference in phase. In binary phase-shift keying (BPSK), the phase has two different states. In quadriphase-shift keying (QPSK) modulation, the phase has four different states. In digital modulation changes in the modulated signal waveform spread the power of the signal to a wide frequency range. The spectrum of the signal comprises usually a wide main lobe at a carrier frequency. The main lobe has smaller side lobes around it on a frequency scale. Before modulation, at a direct current (DC) or baseband, the spectrum is just one half of this and the carrier frequency represents a zero frequency (0 Hz). The lobes are separated by notches, i.e. null points situated at multiples of the data rate (including the multiple of 1), i.e. bit rate (bits per second), from the carrier frequency.

Direct-conversion receivers, i.e. zero-IF receivers are known in the art. In a zero-IF receiver (IF, Intermediate frequency) received signals are mixed with an output of a down conversion oscillator to translate the received signal to the baseband. A down conversion oscillator is a local oscillator generating a signal on the carrier frequency. The phase-modulated input signal is split into two branches and the frequency of the local oscillator is mixed with the two branches (the other one with a 90° difference in phase). The output mixed signal in a branch without

any phase shift is the in-phase signal (I), and the other one having a 90° difference in phase is the quadrature signal (Q). Lowpass or complex filters are provided to remove undesired sum products caused by mixer nonlinearities from the mixing. I/Q signals are preamplified, if needed, and input to analog to digital converters (ADCs) for signal processing. A demodulated signal is calculated from the I and Q signals using a processor system (DSP, Digital signal processing). The I and Q signals also exhibit DC offsets.

In direct-conversion receivers the pure carrier signal gives rise to a DC signal at the mixer output. Other undesired signals at the mixer input give rise to mixing products, the spectrum of which is located around the DC. Other sources of DC offsets include the synchronization of a local oscillator at a carrier frequency and the DC offsets in amplifiers and other circuit elements of the receiver due to temperature, aging, crosstalk, etc. The high gain of the baseband circuitry of the receiver amplifies DC offsets to the extent that the operating range of the circuitry is exceeded. Often the DC offset is compensated using a DC nulling circuitry that measures the offset before the reception and cancels it by means of a voltage that is charged into a large capacitor. High-level transmitters, interfering the reception of a signal of a lower level transmission signal, and starting or stopping their transmission during reception of a spread spectrum device change the DC offset and thus cause disfunctionality in the receiver. The DC offset compensation should be active during the actual spread-spectrum reception, which, on the other hand, results in a more complicated compensation circuitry.

DC offset voltages have a large dynamic range when compared to a useful signal spectrum, resulting in amplifier saturation or problems with the ADC conversion. One method to block the DC offsets is to AC couple the output of the mixer with a large coupling capacitor for generating a narrow notch at a DC frequency. Large capacitors are used to facilitate the use of very low corner frequencies near the zero frequency. The portion of the modulated signal centered around the carrier frequency is also lost, wherein distortion is caused in the demodulation, since the DC notch frequencies contain information.

Large capacitors require high current drive capability consuming a lot of power and using a lot of space on printed circuit boards (PCBs).

Summary of the Invention

An object of the present invention is to provide a method in a direct-conversion receiver for processing received radio signals that are modulated and centered at a carrier frequency as set forth in the preamble of claim 1. According to the claimed invention this objective is obtained by a method characterized in what is presented in the characterizing part of claim 1.

Another object of the present invention is to provide a direct-conversion receiver for processing modulated radio signals that are centered at a carrier frequency as set forth in the preamble of claim 2. According to the claimed invention this objective is obtained by direct conversion receiver characterized in what is presented in the characterizing part of claim 2.

Another object of the present invention is to provide a GPS direct conversion receiver for processing phase-modulated radio signals that are centered at a carrier frequency for receiving digital information as set forth in the preamble of claim 7. According to the claimed invention this objective is obtained by a GPS direct conversion receiver characterized in what is presented in the characterizing part of claim 7.

Another object of the present invention is to provide a method for processing modulated radio signals that are centered at a carrier frequency in a direct conversion receiver as set forth in the preamble of claim 9. According to the claimed invention this objective is obtained by a method characterized in what is presented in the characterizing part of claim 7.

With the invention, considerable advantages are achieved. A portion of the modulated signal centered around the carrier frequency is preserved and information is not lost. The use of other than large capacitors is facilitated since a notch generated by the AC coupling is

situated at notches or null points of the signal spectrum. Consequently, lost modulation energy due AC coupling is considerably lower compared to the case when the AC coupling is at the center of a lobe of the spectrum.

In accordance with the present invention, a local oscillator used exhibits a frequency offset from the carrier frequency of the received signal. In prior art receivers, complicated control circuits were used to tune the frequency of the local oscillator as precisely as possible to the carrier frequency. In the present invention, a direct conversion receiver includes the AC coupling and the offset frequency is such that the frequency spectrum of the modulated signal is moved accordingly to align the DC notch at a spectrum notch, i.e. the frequency of the local oscillator equals with or is about a null point of the modulated signal spectrum, fluctuations and necessary, small differences permitting. Therefore, requirements for the AC coupling are easier to fulfil, the amount of lost energy and information is minimized and distortion of the modulated signal is reduced.

One advantage of the present invention is that high pass filters (for example a first order filter comprising a capacitor in series and corresponding to the AC coupling) in I and Q branches of the receiver are filtering out energy from the offsets which do not contain any significant or any amount of modulation power. The size of the capacitor is determined by a desired frequency crossover point (amount of power reduction vs. null frequency). The higher the value of the capacitor, the lower the high pass frequency will be. Reduction of power increases at frequencies lower than a filter corner frequency which equals to or is slightly higher than the null frequency.

In particular, the present invention is used in spread spectrum systems such as GPS (Global Positioning System) using CDMA techniques. CDMA (Code Division Multiple Access) is a known method of frequency reuse whereby many transmitters use the same frequency but each has a unique code. The transmitted signal is spread over a frequency band much wider than the minimum bandwidth needed to transmit the information being sent. In GPS this is done by modulating

with a pseudo random code. In GPS digital communication the transition time for individual bits is called chip rate, which for the GPS carrier is 1.023 MHz.

In the present invention, the local oscillator offset is set to multiples of 1.023 MHz (first null at 1.023 Hz, second null at 2.046, etc.) equalling to the spectral nulls of a biphase-modulated signal.

Brief Description of the Drawings

In the following, the present invention will be described in more detail with reference to the appended drawings, in which

Fig. 1 shows an example of modulated GPS signal spectrum shown on baseband frequency, and

Fig. 2 shows a block diagram of a direct conversion receiver in accordance with the present invention.

Detailed Description of Embodiments

Fig. 1 shows the most significant part of a modulated GPS signal spectrum at baseband frequency with a main lobe and side lobes, which all form the applicable sideband on both sides of the carrier frequency. The horizontal frequency scale is normalized to correspond the chip rate (inverse of the bit duration time) in order to show the signal going through null points periodically and the spectral notches (i.e. null points) at the multiples of the chip rate. The difference between the notches and the normalized zero frequency correspond to the frequency offset of the local oscillator (the offset frequency equalling to or being about the local oscillator frequency minus the carrier signal frequency). The DC notch caused by the AC coupling is also shown in broken line. The vertical power density scale in decibel (dB) is normalized to correspond to the main lobe. In the present invention, due to the offset frequency, the signal spectrum is moved right and a notch to the left from the main lobe is aligned with the center frequency. The receiver comprises bandpass or complex filtering in I and Q branches for further suppression of undesired mixing

products and adjacent channels. The complex filtering has nonsymmetrical response around zero frequency and they effect better noise bandwidth.

Fig. 2 shows the essential parts of the direct conversion receiver (i.e. zero-IF receiver) 1 to the extent necessary for the understanding of the invention. A more detailed selection of components and subsystems based on this description is clear to a person skilled in the art. A means for receiving and splitting radio signals comprise, for example, an antenna 2, an amplifier 3, and a divider 4). The incoming radio signal (RF, Radio frequency), which is received using the antenna 2 and usually preamplified in the amplifier 3, is split into a first component and a second component (usually using the signal divider 4). The first component is fed to a first mixer means 5 in which the first signal part is mixed with a signal present at first output 6 of a local oscillator 7. As a result of this, an in-phase signal I is generated at the mixer 5 output. Undesired mixing products and also DC offsets are separated off in a filtering means formed by an AC coupling 8 and a first filter 9, for example. The filtered signal is fed to a signal amplifier 10 and after that to a first ADC-converter 11. The signal is further fed to a processor system 12, containing other circuit assemblies and blocks, for demodulation and further processing. Usually the oscillator 7 is regulated, for example to select the offset frequency, by the processor system 12.

The second component is fed to a second mixer means 13 in which the second signal part is mixed with a signal present at a second output 14 of the local oscillator 7. The signal at the second output 14 is phase shifted 90° in relation to the signal at the first output 6. As a result of this, the quadrature signal Q is generated at the output of the mixer 13. Undesired mixing products and also DC offsets are separated off in an AC coupling 15 and a second filter 16. The filtered signal is fed to a signal amplifier 17 and after that to a second AD-converter 18. The signal is further fed to a processor system 12.

The direct conversion receiver forms a part of a receiver system dedicated, for example and specifically, to the GPS reception and

information processing. Further components of the GPS receiver are chosen according to desired specifications in a way known as such to a person skilled in the art.

The invention is not limited to the above-described examples or to the drawings showing examples of one embodiment, but can be varied within the scope of the appended claims.

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Claims:

1. A method in a direct conversion receiver for processing received radio signals that are modulated and centered at a carrier frequency, the modulation extending a sideband above and below the carrier frequency, the method comprising the steps of:

- mixing a local oscillator frequency signal with said received radio signals for generating baseband frequency signals;
- filtering out generated disturbing direct current (DC) components of said baseband signals centered at the zero frequency;

characterised in that the method further comprises the steps of:

- setting said local oscillator frequency signal equal to the carrier frequency plus an offset frequency, said offset frequency being equal to or about the difference between the carrier frequency and a null frequency, said null frequency centered at a notch of said sideband; and
- centering said notch at the zero frequency of said baseband signals through mixing.

2. A direct conversion receiver for processing modulated radio signals that are centered at a carrier frequency, the modulation extending a sideband above and below said carrier frequency, the receiver comprising:

- a means for receiving and splitting said signals, said means having a first signal output and a second signal output;
- a local oscillator means tuned to a local oscillator frequency and having a first frequency output and a second frequency output, said second frequency output having a phase shift compared with said first output;

- a first mixer means coupled to said first signal output and first frequency output for generating baseband frequency in-phase signals;
- a second mixer means coupled to said second signal output and second frequency output for generating baseband frequency quadrature phase signals;
- a first filtering means for the suppression of said in-phase signals centered at the zero frequency;
- a second filtering means for the suppression of said quadrature signals centered at the zero frequency;

characterised in that the local oscillator frequency is set equal to the carrier frequency plus an offset frequency, said offset frequency being equal to the difference between the carrier frequency and a null frequency, said null frequency centered at a notch of said sideband, for centering said notch at the zero frequency of said baseband signals through mixing.

3. A direct conversion receiver according to claim 2, **characterised in** that for channel selection said receiver further comprises a third filtering means for the suppression of said in-phase signals being greater that a set corner frequency; and a fourth filtering means for the suppression of said quadrature signals being greater that a set corner frequency.

4. A direct conversion receiver according to claim 2 or 3, **characterised in** that said first filtering means comprises a first AC coupling means for producing a notch at the zero frequency of said in-phase signal; and said second filtering means comprises a second AC coupling means for producing a notch at the zero frequency of said quadrature signal.

5. A direct conversion receiver according to any of the claims 2 to 4, **characterised in** that said first and second filtering means each comprise a high pass filter coupled to the output of a mixer.

6. A direct conversion receiver according to any of the claims 2 to 5, **characterised in** that said receiver further comprises a processor system for demodulation and processing said in-phase and quadrature signals and for controlling said local oscillator frequency.

7. A GPS direct conversion receiver for processing phase modulated radio signals that are centered at a carrier frequency for receiving digital information, the phase modulation extending a sideband above and below the carrier frequency, the receiver comprising:

- a means for receiving and splitting said signals, said means having a first signal output and a second signal output;
- a local oscillator means tuned to a local oscillator frequency and having a first frequency output and a second frequency output, said second frequency output having a 90° phase shift compared with said first output;
- a first mixer means coupled to said first signal output and first frequency output for generating baseband frequency in-phase signals;
- a second mixer means coupled to said second signal output and second frequency output for generating baseband frequency quadrature phase signals;
- a first filtering means for the suppression of said in-phase signals centered at the zero frequency;
- a second filtering means for the suppression of said quadrature signals centered at the zero frequency;

characterised in that the local oscillator frequency is set equal to the carrier frequency plus an offset frequency, said offset frequency being equal to or about the chip rate or a multiple of it for centering said local frequency at a notch of said sideband, and for centering said notch at the zero frequency of said baseband signals through mixing.

8. A GPS direct conversion receiver according to claim 7, **characterised in** that said first filtering means comprises a first high pass filtering means for producing a notch at the zero

frequency of said in-phase signal; and said second filtering means comprises second high pass filtering means for producing a notch at the zero frequency of said quadrature signal.

9. A method in a direct conversion receiver for processing modulated radio signals that are centered at a carrier frequency, the modulation extending a sideband above and below the carrier frequency, the method comprising the steps of:

- receiving and splitting said signals into first signal output and second signal output;
- tuning a local oscillator frequency for generating a first frequency output and a second frequency output, said second frequency output having a phase shift compared with said first output;
- mixing said first signal output and first frequency output for generating baseband frequency in-phase signals;
- mixing said second signal output and second frequency output for generating baseband frequency quadrature phase signals;
- filtering out in-phase signals centered at the zero frequency; and
- filtering out quadrature signals centered at the zero frequency;

characterised in that the method further comprises the steps of:

- setting said local oscillator frequency equal to the carrier frequency plus an offset frequency, said offset frequency being equal to the difference between the carrier frequency and a null frequency, said null frequency centered at a notch of said sideband; and
- centering said notch at the zero frequency of said baseband signals through mixing.

10. A method according to claim 9, **characterised in** that the method further comprises the steps of high pass filtering said in-phase signal for producing a notch at the zero frequency of said in-phase signal; and high pass filtering said quadrature signal for producing a notch at the zero frequency of said quadrature signal.

Abstract:

The invention relates to a direct conversion receiver and a method in a direct conversion receiver for processing received radio signals that are modulated and centered at a carrier frequency, the modulation extending a sideband above and below the carrier frequency. The method comprises the steps of mixing a local oscillator frequency signal with said received radio signals for generating baseband frequency signals; filtering out generated disturbing direct current (DC) components of said baseband signals centered at the zero frequency; setting said local oscillator frequency signal equal to or about the carrier frequency plus an offset frequency, said offset frequency being equal to the difference between the carrier frequency and a null frequency, said null frequency centered at a notch of said sideband; and centering said notch at the zero frequency of said baseband signals through mixing. The invention relates particularly to suppression of DC offsets generated in the receivers.

(Fig. 2)

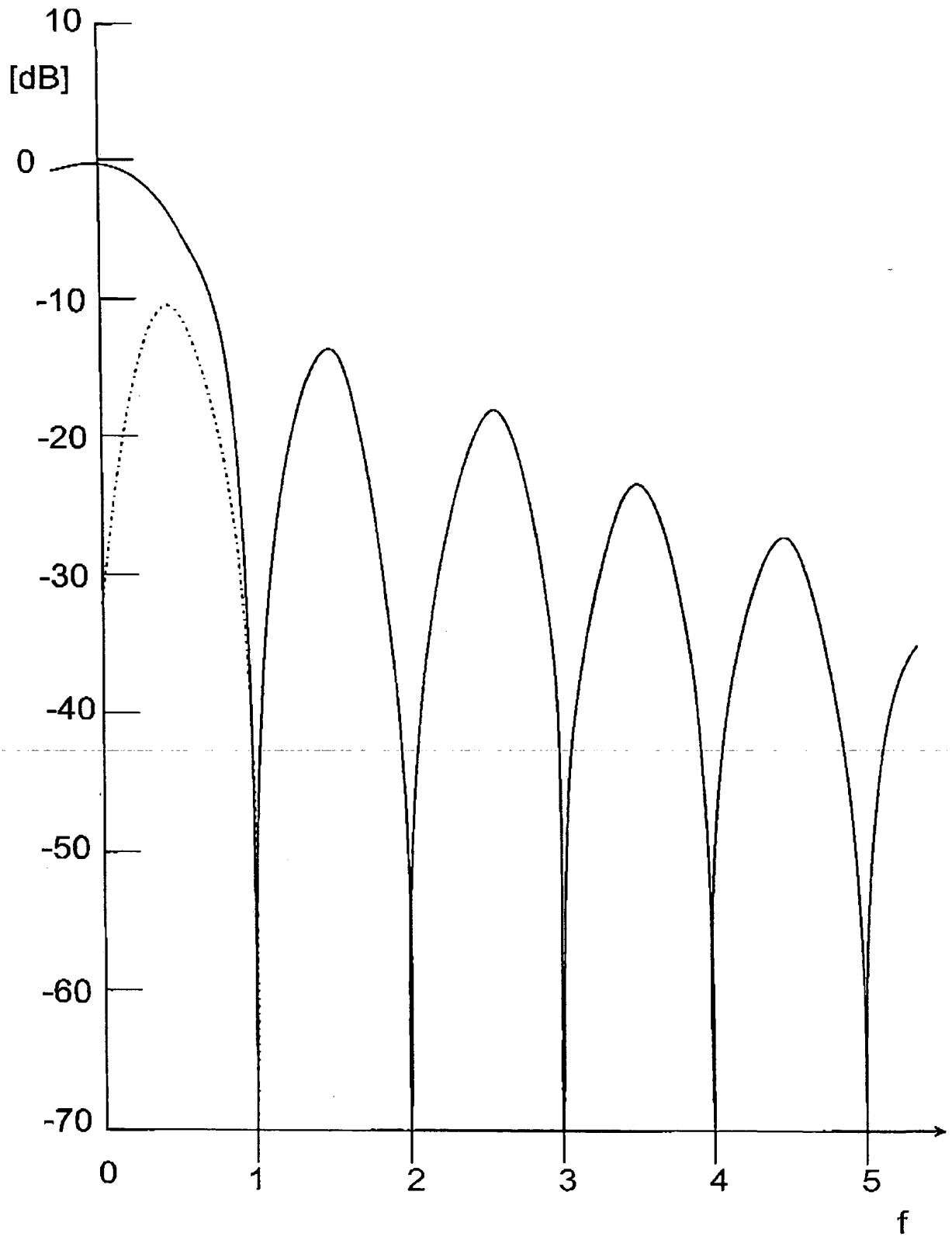

Fig. 1

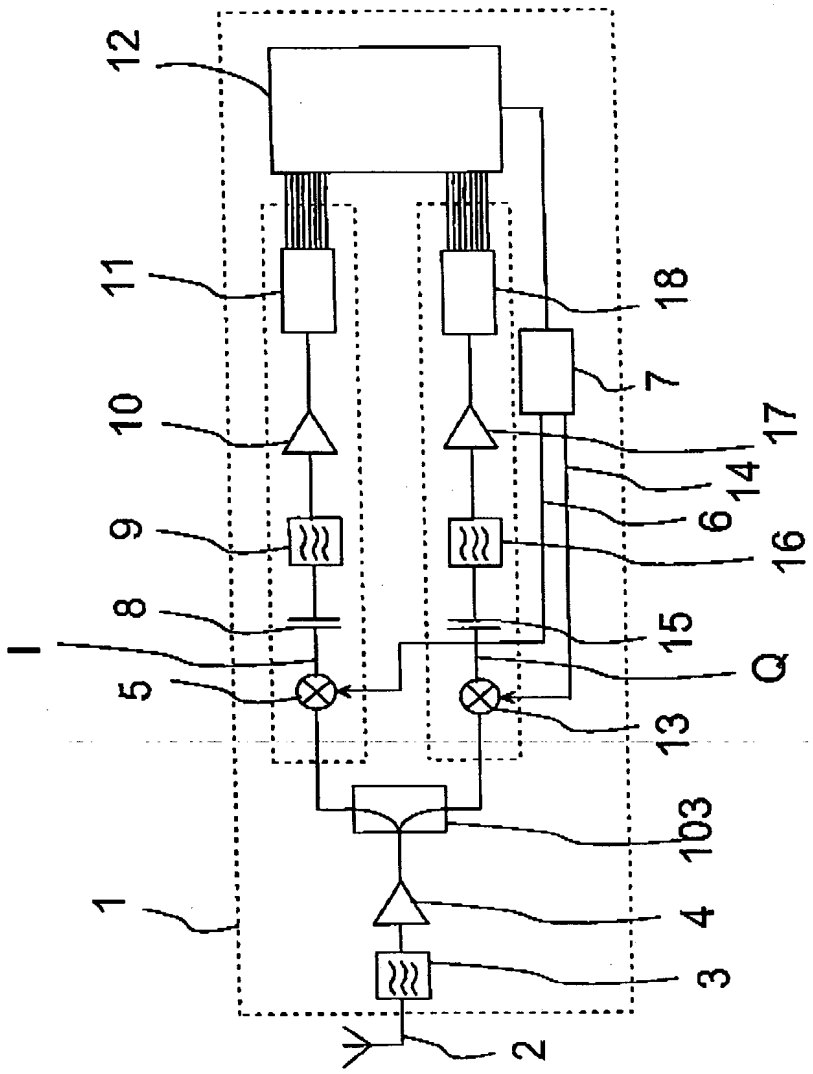

Fig. 2

PATENTTI- JA REKISTERIHALLITUS VÄLIPÄÄTÖS

07.11.2001

Tampereen Patenttitoimisto Oy

Hermiankatu 6

33720 Tampere

Patenttihakemus nro:	20002832
Luokka:	H04B / JP
Hakija:	Nokia Mobile Phones Ltd
Asiamies:	Tampereen Patenttitoimisto Oy
Asiamiehen viite:	TP100080/ER
Määräpäivä:	07.05.2002

Patenttihakemuksen numero ja luokka on mainittava kirjelmässänne PRH:lle

US-patentissa 5850598, julk. 15.12.1998, Sican Gesellschaft fur Silizium-Anwendungen und Cad/Cat, suoramuunnosvastaanottimen paikallisoskillaattorin taajuudelle asetetaan poikkeama signaalin kantoaaltotaajuudesta, jotta dc-komponentin poistossa ei katoaisi informaatiota. Taajuuspoikkeama valitaan niin, että se on päästösuodattimen päästöalueella.

WO-patenttihakemuksessa 99 57912, julk. 11.11.1999, Koninklijke Philips Electronics N.V., käytetään suoramuunnosvastaanottimen dc-komponentin poistossa apuna sitä, että paikallisoskillaattorin taajuus asetetaan hieman moduloidun signaalin taajuudesta poikkeavaksi.

Patenttivaatimuksia 1,2,7 ja 9 pitäisikin täsmentää siten, että maininta siitä, että paikallisoskillaattorin taajuus poikkeaa kantoaaltotaajuudesta, siirretään vaatimusten johdanto-osaan.

Kuvan 2 numerointi poikkeaa ilmeisesti sivun 6 numeroinnista vahvistimen (3 vs 4) ja jakajan (4 vs 103) osalta.

Tiivistelmästä tulisi ilmetä, että keksintö koskee myös GPS-vastaanotinta (PM 21 §).

Vaatimuksista puuttuvat PM 20 §:n mukaiset piirustusta vastaavat, mieluimmin sulkeissa olevat viittausmerkit.

Muissa suhteissa hakemus on suoritetun uutuustutkimuksen perusteella hyväksyttävissä.

Tekniikan tasona viitataan myös US-patenttiin 6029058, julk. 22.2.2000, The Board of Trustee of the Leland Stanford Junior University, jossa ongelma on ratkaistu vaihtoehtoisella tavalla, siten, että signaalin spektriä muokataan niin, että nollataajuuden lähellä on vain vähän energiaa.

Hakijaa pyydetään toimittamaan PL 8 § 5 momentin mukainen käännös englanninkielisenä jätetystä hakemuksesta ja PM 38a § 3 momentin mukainen vakuutus käännöksestä ennen kuin hakemus tulee julkiseksi.

Jari Partanen

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Liitteet: Tutkimusraportti
Viitejulkaisut kahtena kpl:na

Lausumanne huomautusten johdosta on annettava viimeistään yllämainittuna määräpäivänä. Jollette ole antanut lausumaanne virastoon viimeistään mainittuna määräpäivänä tai ryhtynyt toimenpiteisiin tässä välipäätöksessä esitettyjen puutteellisuuksien korjaamiseksi, jätetään hakemus sillensä (patenttilain 15 §). Sillensä jätetty hakemus otetaan uudelleen käsiteltäväksi, jos Te neljän kuukauden kuluessa määräpäivästä annatte lausumanne tai ryhdytte toimenpiteisiin esitettyjen puutteellisuuksien korjaamiseksi ja samassa ajassa suoritatte vahvistetun uudelleenkäsittelymaksun. Jos lausumanne on annettu virastoon oikeassa ajassa, mutta esitettyjä puutteellisuuksia ei ole siten korjattu, että hakemus voitaisiin hyväksyä, se hylätään, mikäli virastolla ei ole aihetta antaa Teille uutta välipäätöstä (patenttilain 16 §). Uusi keksinnön selitys, siihen tehdyt lisäykset ja uudet patenttivaatimukset on aina jätettävä kahtena kappaleena ja tällöin on otettava huomioon patenttiasetuksen 19 §.

Maksu perustuu kauppa- ja teollisuusministeriön antamaan asetukseen 1782/1995 Patentti- ja rekisterihallituksen maksullisista suoritteista muutoksineen.

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PATENTTI- JA REKISTERIHALLITUS
Patentti- ja innovaatiolinja

TUTKIMUSRAPORTTI

PATENTTIHAKEMUS NRO	LUOKITUS
20002832	H04B1/30, H04L27/22

TUTKITTU AINEISTO

Patenttijulkaisukokoelma (FI, SE, NO, DK, DE, CH, EP, WO, GB, US), tutkitut luokat

H03D3/00, H04B1/16, 1/26, 1/30, H04L25/06, 27/14, 27/22 FI, SE, NO, DK

Tiedonhaut ja muu aineisto

EPOQUE, tietokannat EPODOC, PAJ, WPI

Fulltext-tietokantajoukot TXTE, TXTG, TXTF

VIITEJULKAISUT

Kategoria*)	Julkaisun tunnistetiedot	Koskee vaatimuksia
A	US 5850598, julk. 15.12.1998, Sican Gesellschaft fur Silizium Anwendungen und Cad/Cat	1,2,7,9
A	WO 99 57912, julk. 11.11.1999, Koninklijke Philips Electronics N.V.	1,2,7,9
A	US 6029058, julk. 22.2.2000, The Board of Trustee of The Leland Stanford Junior University	1-10

*) X Patentoitavuuden kannalta merkittävä julkaisu yksinään tarkasteltuna
Y Patentoitavuuden kannalta merkittävä julkaisu, kun otetaan huomioon tämä ja yksi tai useampi samaan kategoriaan kuuluva julkaisu
A Yleistä tekniikan tasoa edustava julkaisu, ei kuitenkaan patentoitavuuden este

Päiväys	Tutkija
7.11.2001	Jari Partanen

TRANSLATION FROM THE FINNISH ORIGINAL

NATIONAL BOARD OF PATENTS AND REGISTRATION

OFFICIAL ACTION

7 November 2001

Tampereen Patenttitoimisto Oy
Hermiankatu 6
33720 Tampere

Patent application No.	20002832
Class:	H04B / JP
Applicant:	Nokia Mobile Phones Ltd
Attorney:	Tampereen Patenttitoimisto Oy
Attorney's reference:	TP100080/ER
Term	7 May 2002

The number and class of the patent application must be mentioned in your letter to the National Board of Patents and Registration

In US patent 5,850,598, published on 15 December 1998, Sican Gesellschaft für Silizium-Anwendungen und Cad/Cat, an offset from the signal carrier frequency is set for the frequency of the local oscillator in a direct conversion receiver, to avoid a loss of information during removal of the dc component. The frequency offset is selected so that it falls within the pass range of the pass filter.

In international application WO 99/57912, published on 11 November 1999, Koninklijke Philips Electronics N.V., the removal of the dc component of a direct conversion receiver is enhanced by setting the local oscillator frequency slightly different from the frequency of the modulated signal.

Consequently, claims 1, 2, 7 and 9 should be specified by moving the mention about the difference between the local oscillator frequency and the carrier frequency to the introductory part in the claim.

It seems that the reference numeralsin Fig. 2 are different from the reference numerals in Fig. 6, for the amplifier (3 vs 4) and the divider (4 vs 103).

In the abstract, it should be mentioned that the invention also relates to a GPS receiver (Patent Regulations 21 §).

In the claims, the reference numerals, corresponding to the drawings and preferably given in parentheses, are missing (Patent Regulations 20 §).

In other respects, the application is acceptable on the basis of the search that was carried out.

As to the prior art, reference is also made to US patent 5,029,058, published on 22 February 2000, The Board of Trustee of The Leland Stanford Junior University, in which the problem is solved in an alternative way by modifying the signal spectrum in such a way that there is only little energy close to the zero frequency.

The applicant is requested to file, in compliance with Patent Act, Section 8, Paragraph 5, a translation of the application filed in English, and, in compliance with Patent Regulations, Section 38 a, Paragraph 3, a certificate of the translation, before the application becomes public.

(signed)
Examining Engineer Jari Partanen
Telephone: (09) 6939 5357

ENCL. Search Report
Reference publications (in duplicate)

Your response for the remarks is to be filed up to the above mentioned due date. If you have not filed your response at the Patent Office by the above mentioned due date or taken measures to correct the deficiences expressed in this Official Action, the application is deemed to be withdrawn (Patent Act, 15 §). An application that is deemed to be withdrawn will be accepted under revival if you within four months from the due date file your response or take measures to correct the expressed defects and, within the same term, pay the confirmed fee for revival of the application. If your response is filed at the Patent Office in due time, but the expressed defects are not corrected in a manner that the application could be accepted, it is rejected, unless the Patent Office has a cause to give you a new Official Action (Patent Act, 16 §). A new specification, corrections made thereto, and new claims are always to be filed in duplicate and thus Art. 19 of the Patent Act has to be taken into account.

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NATIONAL BOARD OF PATENTS AND REGISTRATION
Patent and Innovation Department

SEARCH REPORT

APPLICATION NO.	CLASSIFICATION
20002832	H04B 1/30, H04L 27/22

MATERIAL SEARCHED
Classes searched in the record of patent publications (FI, SE, NO, DK, DE, CH, EP, WO, GB, US): H03D 3/00, H04B 1/16, 1/26, 1/30, H04L 25/06, 27/14, 27/22 FI, SE, NO, DK
Data searches and other material EPOQUE, databases EPODOC, PAJ, WPI Fulltext database groups TXTE,TXTG,TXTF

REFERENCES

Category *)	Identification data of the publication	Relates to claims
A	US 5850598, publ. 15 December 1998, Sical Gesellschaft für Silizium Anwendungen und Cad/Cat	1, 2, 7, 9
A	WO 99 57912, publ. 11 November 1999, Koninklijke Philips Electronics N.V.	1, 2, 7, 9
A	US 6029058, publ. 22 February 2000, The Board of Trustee of The Leland Stanford Junior University	1-10

*) X Publication of particular relevance in view of patentability when the publication is taken alone
Y Publication of particular relevance in view of patentability when the publication is combined with one or more such publications
A Publication defining the general state of art, not considered relevant in view of patentability

Date	Examiner
7 November 2001	Jari Partanen